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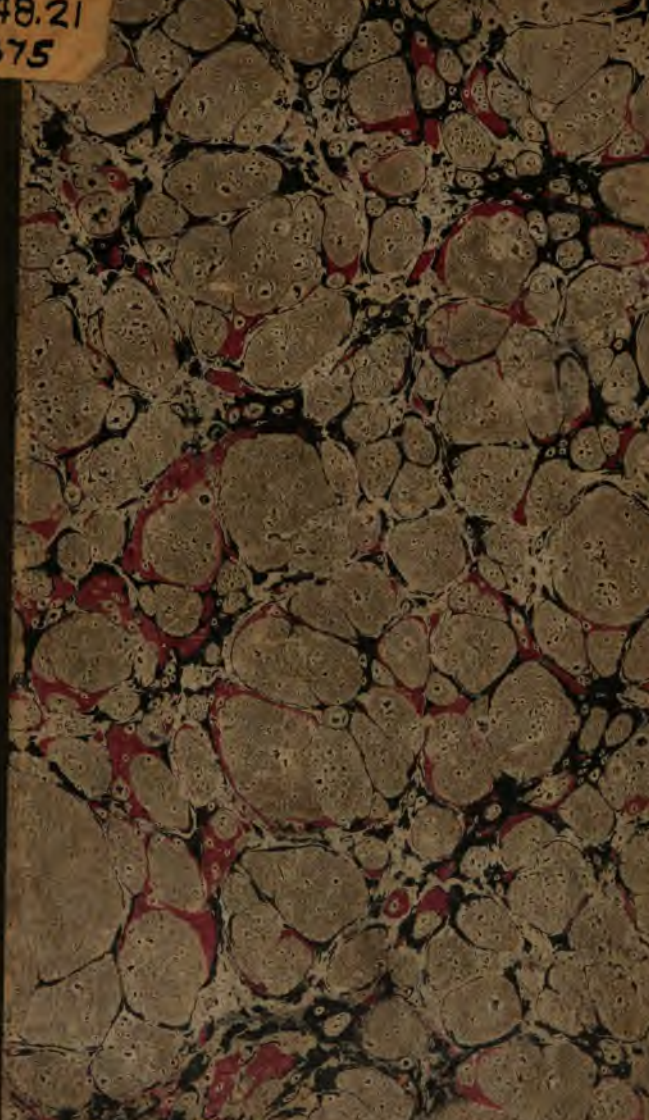
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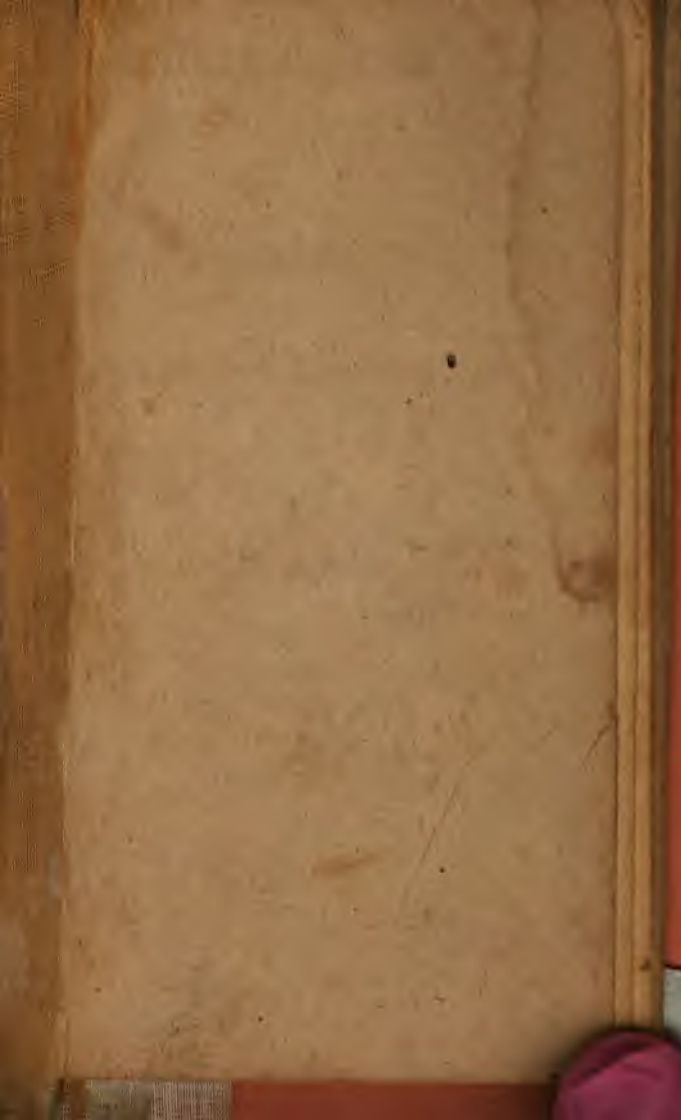
GEOGRAPHICAL

AND

ASTRONOMICAL

Definitions and Explanations.







9
GEOGRAPHICAL

AND

ASTRONOMICAL

Definitions and Explanations.

IN

TWO PARTS.

BY JONAS EVANS,

TEACHER OF GEOGRAPHY.

HAVERHILL:

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1821.

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Rec^d May 5, 1847
Lieut. Robt. W. Thayer,
of Cambridge.

District of Massachusetts, to wit :

DISTRICT CLERK'S OFFICE.

BE it remembered, that on the eleventh day of September, A. D. 1821, and in the forty-sixth year of the Independence of the United States of America, JONAS EVANS of the said District, has deposited in this office the title of a book, the right whereof he claims as Author in the words, following, to wit :
" Geographical and Astronomical Definitions and Explanations. In two Parts. By JONAS EVANS, Teacher of Geography."
In conformity to the act of the Congress of the United States, entitled, " An act for the encouragement of learning, by securing the copies of maps, charts, and books, to the authors and proprietors of such copies, during the times therein mentioned ;" and also to an act entitled, " An act supplementary to an act, entitled, An act for the encouragement of learning, by securing the copies of maps, charts, and books, to the authors and proprietors of such copies during the times therein mentioned ; and extending the benefits thereof to the arts of designing, engraving, and etching historical, and other prints."

JNO. W. DAVIS, { Clerk of the District
 { of Massachusetts.

✍ To furnish his Scholars with some Explanations, and Rules adapted to his Method of instruction, was the motive of the Author in writing the following Sketch of Geography and Astronomy.

PART I.

Geographical Definitions, &c.

1. Geography is that science which describes the Earth.

The term Geography is derived from the Greek *ge*, the earth and *grapho*, to describe.

2. Simple Geography treats of the Earth under Six Grand Divisions of land, viz. Europe, Asia, Africa, North America, South America, and New Holland; and Five Grand Divisions of water, as follow—

3. The *Atlantic Ocean*; this Ocean divides Europe and Africa, from America, and derives its name from the Atlas Mountains in Africa.

The *Pacific Ocean*; this Ocean lies between Asia and America, and derives its name from its pacific, or peaceful waters.

The *Indian Ocean*; this Ocean lies

south of Asia, and derives its name from the river Indus.

The *Arctic*, and *Antarctic Oceans* are properly vast unexplored fields of ice, and derive their names from two circles.

4. *A Continent*, (so called from the Latin *continens*, i. e. containing, continuing,) is a vast extent of land containing many countries not separated by water ; as the Western Continent. There are three Continents, the Eastern, Western, and Southern.

SMALLER NATURAL DIVISIONS OF LAND.

5. *An Island* (from the Lat. *in*, and *sola* i. e. in the Sea) is a tract of land surrounded by water ; as Iceland.

6. *A Peninsula*, (from the Lat. *pene* almost, and *insula* an island) is a portion of land *almost* surrounded by water ; as Nova Scotia.

7. *An Isthmus* (from the Gr. *eiseimi* to enter) is the entrance to a peninsula, or the neck of land which joins a peninsula to a larger portion of land ; as Darien Isthmus.

8. *A Promontory* (from the Lat. *pro-*

montorium a mountain projecting into the Sea) is a portion of land extending into the Sea without an isthmus; as East Florida.

9. *A Cape* (from the Lat. *caput* the head) is a head land, or extreme point of a promontory; as Cape Florida.

10. *A Shore* or *Coast* is the land which borders on the water.

11. *A Volcano* is a burning mountain which emits smoke, and flame; as Etna.

Volcano is derived from *Vulcan*, the fabled blacksmith of Jupiter, who was said to reside in Etna, and there forge thunderbolts for that deity.

SMALLER NATURAL DIVISIONS OF WATER.

12. *A Sea*, or *Lake* is a portion of water nearly enclosed by land; as the Black Sea, Lake Michigan.

13. *A Bay*, or *Gulf* is a portion of water extending into the land; as the Bay of Fundy, the Gulf of California.

14. *A Harbour*, or *Haven* is a small bay or portion of water where ships may ride at anchor; as Boston Harbour.

15. *A Strait* (i. e. narrow) is a narrow passage of water uniting two larger portions; as the Strait, or Straits of Gibraltar.

16. *A Channel* is a broad passage of water; as the English Channel.

17. *A Frith*, or *Estuary* (from Lat. *æstuarium*) is an arm of the Sea, or the broad mouth of a river, where the tide ebbs and flows; as the Frith of Forth.

18. *A River* is a large stream of water flowing into a Lake, Sea, or other river.

19. *A Cataract* (from the Gr. *cata* against and *rasso* to dash,) is a large current of water falling over a precipice; as Niagara Cataract.

20. *A Vortex*, or *Whirlpool*, is a portion of water moving violently in circular whirls; as Maelstrom.

21. *An Archipelago* (from Gr. *Ægeopelagus* i. e. the *Ægean Sea*) implies a Sea, or portion of water interspersed with numerous islands; as the Caribbean Sea.

The *Solar divisions* of the Earth's surface have respect to heat and cold, light and darkness.

22. These are five broad circular Strips called *Zones* (from the Gr. *Zone* a belt.)

The *Zones* are included between parallels of latitude.

23. The *Torrid Zone* (from the Lat. *torreo* to roast) is that portion of the earth over every part of which the Sun is vertical twice in a year.

The ancients who penetrated the *Torrid Zone* in Arabia and Africa, and there found vast deserts of sand, supposed the heat in this Zone was so intense as to destroy animal life, and even vegetation; hence they gave it the significant name of "*roasting Zone*." The *Torrid Zone* is bounded by the circles called *tropics*.

The sun is *vertical* to a place when directly over the heads of its inhabitants.

24. The *North temperate Zone* is bounded on the north by the Arctic circle, and on the south by the tropic of Cancer.

25. The *South temperate Zone* is bounded on the north by the tropic of Capricorn, and on the south by the Antarctic circle.

The temperate Zones are two belts or portions of the earth to which the Sun is never vertical, and the inhabitants of which never see the sun more than 24 hours without setting. These Zones are called *temperate*, because their climate is neither so hot as the torrid, nor so cold as the frigid Zones.

26. The *North Frigid Zone* (from the Lat. *frigidus* frozen) is bounded by the Arctic circle.

27. The *South Frigid Zone* is bounded by the Antarctic circle.

These Zones are not properly *belts*, but rather portions of the earth's surface where the inhabitants see the Sun more than 24 hours together some part of the year.

28. A *Globe* is a round body whose surface is every where equally remote from its centre.

A *Terrestrial Globe* (from the *terrestris* earthly,) is a just representation of the Earth's surface, showing countries, seas, &c. in their relative size and position.

29. A *Map* is a picture of the whole or a part of the Earth's surface; always more, or less compressed toward the middle, because no flat surface can accurately represent a convex, or globular surface.

30. An *Hemisphere* (from *hemi* and *sphere* a globe) is half of a globe, or the picture of half a globe.

The *Diameter* of a globe, or a circle (from the Gr. *dia* through, and *metron* to measure) is a line passing from one side to the other, directly through the centre.

The *Radius* of a circle is its semi-diameter i. e. half its diameter.

31. The diameter of the globe is



plied by its circumference will show its superficial content. The surface, or area of a globe multiplied by one sixth of its diameter will show its solid content.

32. The *Axis* of the Earth (from the Gr. *axo* to turn) is a supposed spindle on which it seems to turn daily.

The *ends* of this *Axis* are called the *poles*, from the Gr. *poleo* to whirl.

The *North* end always points toward the north polar Star.

The *South* end is called the *South pole*, and points toward the South polar Star.

Geographers are represented as ever looking toward the North polar Star, hence the top of every map is *north*.

33. When the Sun is vertical exactly between the north and south poles, as he shines around the circumference of the Earth in 24 hours he is supposed to mark a circle directly under him.

This circle is called the *equator* (from equal) because it is equally distant from the poles, and the plane of it would divide the earth into equal parts, i. e. into Northern and Southern Hemispheres.

34. When the Sun is vertical at the equator, the days and nights are equal all over the earth; hence this circle when referred to the heavens is called the *equinoctial line*, from the Lat. *aequus* equal and *nox* night.

People who live on the equator have their days, and nights of equal length or each 12 hours in length all the year because in all parts of the earth's circumference the equator will be divided into equal parts by the horizon.

To all places north and south of the equator, the days and nights are of equal length but twice in the year, viz. on the 21st of March and 23d of September.

35. *Climates* are included between two such parallels of latitude that the longest day in the parallel most remote from the equator shall be half an hour longer than in the other.

Climate is from the Gr. *clima* a declination, because in numbering the climates they *decline* from the equator toward the pole.

The longest day at London is about 16½ hours. From this take 12 hours and 9 half hours will be left; hence



London is in the 9th climate from the equator.

Between the equator and the pole are 30 climates ; but in the frigid zone climates are measured by the increase of a *Month*.

36. When the Sun is as far north of the equator as he ever shines vertically, he is supposed to mark a circle around the earth, which is called the *tropic* of Cancer, from the Gr. *trepo* to turn, because he then seems to *turn* and move toward the equator.

37. The tropic of Capricorn is a circle *south* of the equator corresponding to that of Cancer *north*.

38. The *Arctic Circle* from the Gr. *arctos* the bear, a northern constellation) is described around the north pole at the distance of $23\frac{1}{2}$ degrees, and bounds that portion of the earth where the sun shines more than 24 hours without setting, or the North Frigid Zone.

39. The *Antarctic circle* (from the Gr. *anti* opposite, and *arctos* the bear) is described around the south pole at the distance of $23\frac{1}{2}$ degrees, and bounds the South Frigid Zone.

40. A *great circle* is one, the plane of which would divide the earth into equal parts.

The *Equator* is a *great circle* passing around the earth from east to west equally distant from the poles.

41. The *Tropic of Cancer* (or the Crab) is a smaller circle drawn parallel with the equator $23^{\circ} 28'$ north of it, and bounds the torrid zone on the north.

42. The *Tropic of Capricorn* (or the Goat) is a smaller circle drawn parallel with the equator $23^{\circ} 28'$ south of it and bounds the torrid zone on the south.

43. A *Meridian* (from the Lat. *meridies*, middle of the day) is a great circle passing directly from pole to pole around the earth, and crossing all the parallels of latitude at right angles.

When the Sun is vertical at a meridian, it is then noon, or middle of the day to all people on that meridian who can then see the sun; hence people who live on the same meridian have the same hour of the clock at the same time.

44. *Lines of longitude* are properly half meridians, or semi-circles extending from the north pole to the south, and cutting the equator at right angles.

Every place on the earth is supposed to have a line

of longitude passing through it which is shown when that place is brought to the brazen meridian.

45. That meridian which passes over the equator at the points where the plane of the ecliptic intersects it, is called the *equinoctial Colure*, from the Gr. *kolos* cut, or notched, because notches were cut in the ancient Armillary sphere to support it.

46. That meridian which passes over the tropics in the points where the ecliptic touches them, is called the *Solstitial Colure*, from the Lat. *sol* the sun, and *sto* to stand; because when in these points, the sun *stands*, or appears stationary without proceeding farther from the equator.

47. The *Ecliptic* is a great circle supposed to be drawn on the heavens under certain stars.

It is the path through which the sun appears to move in one year, or the real orbit of the earth.

It is called ecliptic from the Gr. *eclipse*, to be deficient or eclipsed, because no eclipse of the sun or moon can happen except when on or near the plane of this circle.

48. The *real Horizon* (from the Gr.

horizo to bound) is a great circle which bounds our sight of one half of the starry sphere, and the plane of which would divide the earth into upper and lower hemispheres.

On this we mark the rising, and setting of the sun, stars, and planets.

The *wooden horizon* of a terrestrial Globe rectified for any place, represents the *real horizon* of that place.

The *apparent, or sensible horizon* bounds our prospect on the land or water.

If a man six feet tall stand on a large plain or the surface of the water he may see an extent of about three miles from him; hence the whole circumference of his apparent horizon would be less than twenty miles.

It is obvious that our apparent horizon changes as often, and as fast as we move from a place.

49. Longitude is a distance from a meridian either east, or west, reckoned in degrees on the equator or on a parallel of latitude.

No place can be in more than 180 degrees of longitude from another place; because this is *half* the circumference of the globe.

Longitude is from the *Lat. longitudo* length, because the maps of the ancients extended farther from east to west, than from north to south.

50. *Latitude* (from the Lat. *latitudo* breadth) is a distance from the equator toward the pole, either north or south, reckoned in degrees, and cannot exceed ninety.

51. The ancients divided the circumference of every circle whether large or small into 360 equal parts called *degrees*; hence a degree of latitude is the 360th part of the earth's circumference, or of a great circle on the earth.

A degree of a great circle in the heavens is a space about twice as long as the apparent diameter of the sun, or moon.

52. The *plane* of a circle is its extent, or area without reference to thickness.

The earth cut by the plane of a great circle, would be divided into *equal* parts; if cut by the plane of a smaller circle, into *unequal* parts.

53. The *Cardinal points* (from the Lat. *cardo* a hinge) are the four points East, West, North, and South. The ancients had but four points, and the wind was said to blow from that point to which it was *nearest*.

The cardinal points of the Ecliptic are

the first degree, or point in the signs, Aries, Cancer, Libra, and Capricorn.

Places on the equator have no latitude. The poles have no longitude; because at them all the meridians meet.

54. All places on the earth are south from the north pole, and north from the south pole.

Every part of the earth has the sun's light half of the year.

On the 20th of March and the 23d of September the sun rises in the *East* point and sets in the *West* point to all the inhabitants of the earth.

55. The *Altitude* of the sun, or a heavenly body (from the Lat. *altitudo* height) is its apparent height above the horizon, reckoned in degrees, or measured by a quadrant.

56. *Declination* (from the Lat. *declinatio*, a digression) is the vertical distance of the sun, or a heavenly body either north or south of the equator, reckoned in degrees. The declination of the sun is never more than $23^{\circ} 28'$; of a star never over 90 degrees.

57. The *Zenith* is that point in the heavens directly over our heads, and 90 degrees from the horizon.

The north polar star is always in the zenith of the north pole.

58. The *Nadir* is the point in the heavens *opposite* the zenith, or directly under our feet.

Our nadir is the zenith of our antipodes.

The axis of the earth extended to the heavens represents the axis of a celestial globe, the extremities of which are the poles of the heavens, about which the heavenly bodies appear to revolve.

59. The *Antoeci* of a place (from the Gr. *anti* opposite, and *oikeo* to dwell) are those people who dwell under the same meridian, on *opposite* sides of the equator, and equally distant from it.

They have noon at the same time, but opposite seasons of the year; and the length of the *day* to the one, corresponds with the length of the *night* to the other.

People on the equator have no Antoeci. The *Egyptians* are Antoeci to the *Natalese* of South Africa.

60. The *Peroeci* of a place (from the Gr. *peri* about, and *oikeo* to dwell) are those people who live on the same parallel of latitude but in opposite longitudes, or 180 degrees of longitude asunder.

They have the same seasons, but

when it is *noon* with one, it is *midnight* with the other.

The inhabitants on the *Fox Islands* are *Peroeci* to the people of *London*.

61. *Amphiscii* (from the Gr. *amphis* both, and *skia* a shadow, or two shadows) is a name given to the inhabitants of the torrid zone; because at one time of the year their shadows fall toward the *south*, and at another, toward the *north*.

62. These are also called *Ascii* from the Gr. *a* without, and *skia* a shadow, because the sun being twice in the year in their zenith their bodies at those times cast no shadow.

When the sun's altitude is 45 degrees above the horizon the shadow of any perpendicular object is just equal to its height.

63. The inhabitants of the frigid zones are called *Periscii*, because their shadows move around them; or their shadows during a rotation of the earth on its axis, are directed toward every point of the compass.

64. *Antipodes* (from the Gr. *anti* opposite, and *podes* feet) are those people who live on opposite sides of the earth,

so that a direct line from one to the other would pass through the centre of the earth.

When it is *noon* to one, it is *midnight* to the other. They walk feet to feet, and have 180 degrees difference of longitude.

If situated in *opposite* latitudes their seasons of the year, length of days and nights, &c. are contrary.

The inhabitants of *Sumatra Isle* are Antipodes to those who live near *Quito* in South America.

65. The position of the Globe or Sphere to the inhabitants on the equator is said to be *right* ; because all the parallels of latitude cut their horizon at right angles, and their horizon divides the equator into equal parts making equal day and night all the year.

66. If there were inhabitants at the poles they would have what is called a *Parallel Sphere* ; to them all the parallels of latitude would be parallel to the horizon, and the sun would appear above their horizon half of the year.

67. Those who live between the equator and poles, have what is termed an

oblique Sphere ; their horizon cutting the parallels of latitude obliquely divide them into unequal parts, and their days and nights are of unequal length.

OF THE EARTH AS A MEMBER OF THE PLANETARY FAMILY.

68. The Earth is one of the Planets. It is 95 millions of miles from the sun, around which it annually revolves in an elliptical orbit or path, i. e. an orbit approaching an *oval* form.

69. The Earth in shape is nearly a globe. Its diameter is about 8000 miles, and its circumference of course a little more than three times as many, or about 25,000 miles.

The surface of the earth is about 200 millions of square miles. About 50 millions are land, and the rest water.

The weight of the earth is estimated at over 4000 trillions of tons.

There are three planets larger, and three smaller than the earth.

70. The earth in common with the other planets has three regular motions, viz. an *axis*-motion, an *orbit*-motion, and a *system*-motion.

The *first* produces our succession of day and night.

The *second* produces our variety of seasons, in connexion with the inclination, or rather *declination* of the earth's axis from being perpendicular to the plane of its orbit.

The *third* has no perceptible influence.

The axis motion of the earth has rendered it an *oblate spheroid* in shape, i. e. a globe flatted at its poles.

As the earth constantly turns on her axis from west to east toward the sun; the sun always appears rising on some parts of the earth, and setting on other parts.

71. The motion of the earth on, or around its axis is called its *rotation*.

Each rotation constitutes a day.

72. A *solar* day is the time from one noon to the next noon, or from the instant when the centre of the sun is over a meridian to the moment when he is over the same meridian again.

A solar day varies in length, sometimes *more* and sometimes *less* than 24 hours; because the orbit of the earth is not a perfect circle, and in some parts of it she moves *faster* than in others.

Hence the sun and clock do not always agree.

73. The *sidereal* day (from the Lat. *sidus* a star) is the time in which the earth turns on its axis from one star to the same again, or it is one entire rotation of the earth on her axis.

A solar day is necessarily *longer* than a sidereal day because the earth is constantly moving onward in her orbit.

The sidereal day is always of the same length, viz. about 23 hours 56 minutes. If the earth had no motion but its axis motion the length of the day would uniformly be 23h. 56m. 4sec.

The earth must have 366 axis rotations in order to produce 365 solar days, on account of the direction of her orbit and axis-motions.

74. The revolution of a body is the time in which it moves from a point in its orbit to the same point again.

The earth moves from the vernal equinoctial point to the same point again about 20 minutes sooner than it arrives precisely under the same star where it was observed one year before.

75. This is called the *precession* of the equinoxes (from the Lat. *præ* before,

and *cede* to go) or rather *recession* as it is a slow motion which the equinoctial points have *back*, or from east to west, contrary to the order of the signs.

The precession of the equinoxes is thought to be caused as follows ;

The equatorial or greatest diameter of the earth, being constantly turned toward the sun, his attraction brings about a revolution *sooner* than the earth moves from a fixed star to the same star again.

76. The solar or equinoctial year is about 20 minutes *shorter* than the sidereal or star-year; and the two points where the equator intersects the ecliptic move backward or precede their previous places about 50'' a year; a motion which would carry them quite around the circumference of the equator in about 26,000 years.

It is supposed that about 2000 years ago, or in the time of Hipparchus, the equinoctial Colure passed through the middle of the constellation Aries.

The motion of the equinoctial points varies the situation of the stars as seen from the earth, or alters their longitudes, &c. which renders it necessary to have new plates engraven for the celestial globe, at least every half century.

Did the earth move around the sun with her axis *perpendicular* to the plane of her orbit (as some suppose she did originally) we should have no variety of seasons.

77. The north polar star toward

which the axis of the earth points, is $23^{\circ} 28'$ from being perpendicular to the plane of the ecliptic.

The north polar star is a star of the second magnitude, or rather, *two* stars so nearly on a line with each other as to appear but *one* to the naked eye.

It is not *exactly* in the zenith of the north pole, but appears to have a small motion around a point which would be pierced by the axis of the earth, if extended infinitely, at the distance of 3 1-3 apparent diameters of the sun, or nearly two degrees of a great circle.

The south polar star is at the distance of about 20 2-3 apparent diameters of the sun from the south pole point.

On the equator an observer sees both the north and south polar stars nearly level with the horizon.

As he departs from the equator toward the north, he loses sight of the south polar Star, and the north appears to rise above the horizon.

78. The elevation of the north polar Star (from the Lat. *elevo* to lift up) is always equal to the latitude of the place where it is observed.

At the north pole of the earth, the north polar Star would appear over a spectator's head, and the Sun when north of the equator would appear to move around from east to west in a circle all above the horizon and parallel with it.

79. The inhabitants near the north pole have more light in a year than any

other people on the earth ; because the Sun is a week longer in passing through the northern signs, than the southern ; and hence *more* than half the year above the horizon as seen from the north pole.

Also the refraction of light, the reflection of the Moon's light from snow, and the brightness of the Aurora Borealis are greater here than in any other part of the earth.

ON THE USE OF MAPS.

80. The degrees of latitude are marked on the *side* borders of the map.

The degrees of longitude are marked on the equator, or in the *top* and *bottom* borders of the map.

To find a place by its *longitude* and *latitude*.—Move the finger from that meridian which has no longitude *east* or *west*, till you arrive at the given longitude ; then moving it *north* or *south* on that meridian according to the latitude given, you will arrive at the place.

All places under the same parallel of latitude have the same latitude.

All places on the same meridian have the same longitude, and the same hour of the clock for *half* the meridian circle ; on the other half of the circle the difference of longitude is 180 degrees, and the time 12 hours earlier, or later.

81. At the poles there is no longitude; for here all the lines of longitude meet.

To find the *Antipodes* of a place.—Put your finger where the meridian of the place intersects the equator, from thence count 18 meridian or 180 degrees, and then move *north* or *south* as many degrees as the given place oppositely.

To find the *Antoeci* of a place.—Follow the meridian of the place as far *south* of the equator as the place is *north* or *vice versa*.

To find the *Peroeci* of a place.—Count on the same parallel 18 meridians, or 180 degrees *east* or *west* and you arrive at the *Peroeci*.

To find the elevation of the north polar star.—Seek the latitude of the place, (the place must be in the *north-ern* hemisphere) and the degrees of latitude will be the number of degrees at which the north polar star appears above the horizon.

To find how much the axis of the Earth declines from being perpendicular to the plane of its own orbit.—Find how many degrees from the equator the sun is ever vertical, and so many degrees the earth's axis declines.

82 To find the difference of time between two places.—Ascertain their difference of longitude, and for every 15 degrees of longitude allow *one hour*; or four minutes to every degree *adding* when *east* and *deducting* when *west* of the given place.

Thus, when it is noon at Boston it is 4 o'clock and 42 minutes P. M. at London; because London is $70\frac{1}{2}$ degrees *east* of Boston.

If the Sun is setting at a place on the equator, 90 degrees *east* of that place it is midnight, 90 degrees *west* it is noon, and the Sun is rising at the Antipodes of the place.

The nearer any place is to the equator, the difference between the length of its days and nights is proportionably less.

The longest day in the torrid zone is never more than $13\frac{1}{2}$ hours.

GRAVITATIVE ATTRACTION

83. Is a misterious power by which all material bodies appear to be affected.

All bodies attract in regular proportion according to their respective quantities of matter and distances from each other.

Bodies at *half* the distance from their centre of gravity attract each other by a force *four* times *greater*.

84. The sun attracts all the planets, and all the planets attract the sun, but his attraction is as much *greater* than theirs as he is *heavier* than they are.

A stone thrown up from the earth attracts the earth toward itself as much *less* than the earth attracts that as the stone is *smaller* or *lighter* than the earth.

Saturn is but *half* as far from the sun as Herschel hence he is attracted by a force *four* times *greater*.

The orbit-velocity of Herschel is proportioned to the force by which the sun attracts him. Herschel moves but *three* miles in his orbit while Saturn moves *four*.

The attraction of gravitation constitutes weight in bodies, and leads bodies to approach each other.

By the laws of attraction the tides, the motion of the planetary bodies, &c. are explained.

TIDES

85. Are a successive rise and fall in the waters of the ocean.

The waters from their yeilding nature

are swelled by the attraction of the moon and sun.

At new moon, or when the attractions of the sun and moon are in coincidence the tides are increased.

When the moon is at *first* or *last* quarter, her attraction *raises* the waters where the sun's attraction *depresses* them; hence the tides are then diminished.

86. About new and full moon we have *spring* tides, and at first and third quarters *neap* tides.

In confined seas, and lakes, the tides are inconsiderable.

The tides are like a great wave moving around the earth once in about 25 hours.

But the various islands and continents obstruct their regular motion, and render their theory imperfect.

Were it not for this, when the moon was at the meridian of a place it would invariably be flood-tide there, and also at the Peroeci, and Antipodes of that place at the same time.

And when the moon appeared in the horizon of a place, that place would always have ebb-tide, or low water.

ATMOSPHERE.

87. The atmosphere is a fine agitable fluid, encompassing the earth, and extending nearly 50 miles above its surface.

It is attracted to the earth, and moves with it. It *reflects* and *refracts* the sun's rays.

It is the element of birds, and an immense reservoir of vapours.

It is susceptible of *compression* and *expansion*.

88. Heat *expands*, and cold *condenses* it.

The atmosphere is composed of different sorts of air, and is the medium of sound.

It supports clouds which refresh the earth with showers, or embellish the sky with a variety of figures, or excite our attention by their vivid flashes, and rolling thunder.

LIGHT.

89. The science of light is interesting and sublime.

The rays of light which proceed from the sun are of seven different colours, which may be separated by a prism or

piece of glass, and each retain its own original colour.

90. These seven primary colours which may be seen in a rainbow are *Violet, Indigo, Blue, Green, Yellow, Orange, and Red*; and may be remembered by the word "*vibgyor*" which contains the initial letter of each colour.

91. By unequal mixtures of these rays all our variety of hues is produced.

92. *White* is a mixture of all the seven original colours together, and bodies which appear white reflect nearly all the rays of light that fall on them equally.

Coloured bodies, reflect chiefly the the rays of that colour which distinguishes them, and absorb or swallow up the rest.

93. Substances which appear *black*, absorb instead of reflecting the rays of light that fall on them.

94. The rays of light move in straight lines with a velocity of 200,000 miles in a second of time, or 12 millions of miles in a minute.

95. But when the rays of light pass out of one medium into another of differ-

ent density they are *bent* from a straight line. This bending of the rays of light is called *refraction*.

96. By refraction we see the sun about *five minutes* before he rises, and as long after he is below the horizon.

97. Twilight is occasioned by refraction and reflection ; and were it not for this we should have a sudden transition from midnight darkness to broad daylight, which would be very injurious to our eyes.

The Sun is the great dispenser of light, and the only luminous orb in our system.

He is made a lively figure of that omnipotent Power who in the beginning said " Let there be light, and there was light," and who now enlightens the vast universe of Worlds with his presence, and continues " God over all blessed for ever more."

END OF PART I.

QUESTIONS.

☞ *The figures refer to the numbers under which the answers may be found.*

1. What is Geography ?
2. Of what does it treat ? How many grand divisions of land are there ? How many of water ?
3. From whence is the name of the Atlantic ocean derived ? the Pacific ? the Indian ? the Arctic ? the Antarctic ?
4. What is a Continent ? How many are there ?
5. What is an Island ? 6. A Peninsula ?
7. An Isthmus ? 8. A Promontory ?
9. A Cape ? 10. A Shore ? 11. A Volcano ?
12. A Sea or Lake ? 13. A Bay or Gulf ?
14. A Harbour or Haven ? 15. A Strait ?
16. A Channel ? 17. A Frith ? 18. A River ?
19. A Cataract ? 20. A Vortex ?
21. An Archipelago ?
22. How many Zones are there ?
23. What is the torrid Zone ? How is it bounded ? 24. How is the North temperate Zone bounded ?
25. How the South temperate ?
26. How is the North frigid Zone bounded ?
27. How the South frigid ?
28. What is a Terrestrial Globe ?
29. What is a Map ?
30. What is an Hemisphere ? What is the diameter of a globe or circle ? What is the radius of a circle ?
31. How is the superficial content of a globe found ? How the solid content ?
32. What is the axis of the earth ? What are

the ends of this axis called? Toward what does the north end point? What part of a map is north?

34. When are the days and nights of equal length over all the earth? To what part of the earth are the days and nights 12 hours in length all the year?

35. How many climates are there between the equator and pole? In what climate is London?

38. What is the Arctic Circle?

39. What is the Antarctic Circle?

40. What is a great Circle? What is the Equator?

41. What is the tropic of Cancer?

42. What is the tropic of Capricorn?

43. What is a Meridian?

45. Which Meridian is called the equinoctial Colure?

46. Which is called the solstitial Colure?

47. What is the ecliptic?

48. What is the *real* horizon? What is the *apparent* horizon?

49. What is Longitude? 50. What is Latitude?

51. What is a degree?

52. What is the plane of a circle?

53. What are the cardinal points? What are the cardinal points of the ecliptic?

54. When does the sun rise in the east point?

55. What is the altitude of the sun or a heavenly body?

56. What is the declination of a body?

57. What is the Zenith? What star is in the Zenith of the north pole?

58. What is the Nadir?

59. Who are the Antoeci of a place?
60. Who are the Peroeci?
- 61—2. Who are called Amphiscii, and Ascii? When is the shadow of a perpendicular object 1st equal to its height?
63. Who are called Periscii?
64. Who are the Antipodes of a place?
65. What inhabitants of the earth have a right sphere?
67. Who have an oblique sphere?
68. How far is the earth from the sun? How often does she move round him? What is the form of her orbit?
69. What is the shape of the earth? What is her diameter? What her circumference? How many square miles is the surface of the earth?
70. What does the axis motion of the earth produce? What her orbit motion?
72. What is a solar day?
73. What is a sidereal day? Which is longest? How many rotations has the earth in a year?
74. What is the revolution of a body?
75. What is the precession of the equinoxes?
76. Which is longest the solar or sidereal year?
78. To what is the elevation of the polar star equal?
79. Have the inhabitants of the north frigid Zone more or less light in a year than other people?
80. On what part of a map are the degrees of latitude marked? Where are the degrees of longitude marked?
81. What is the longitude of the poles?
82. How is the difference of time between

two places found? When it is noon at Boston what o'clock is it at London? How long is the longest day in the torrid zone?

83. What is gravitative attraction?

84. How much greater is the attraction of the sun upon the planets than theirs upon him? Which is attracted most powerfully by the sun, Saturn, or Herschel? Which of these two planets moves fastest?

85. What are tides?

86. When do we have spring tides? When neap tides?

87. What is the atmosphere? How high above the surface of the earth does it extend? Is it attracted to the earth?

88. What expands the atmosphere? What condenses it?

89. Of how many colours are the rays of light? How may these colours be separated? How many colours are seen in a rainbow? What are the seven primary colours called?

90. How may their names be remembered?

91. How is all our variety of hues produced?

92. Why do some substances appear *white*?

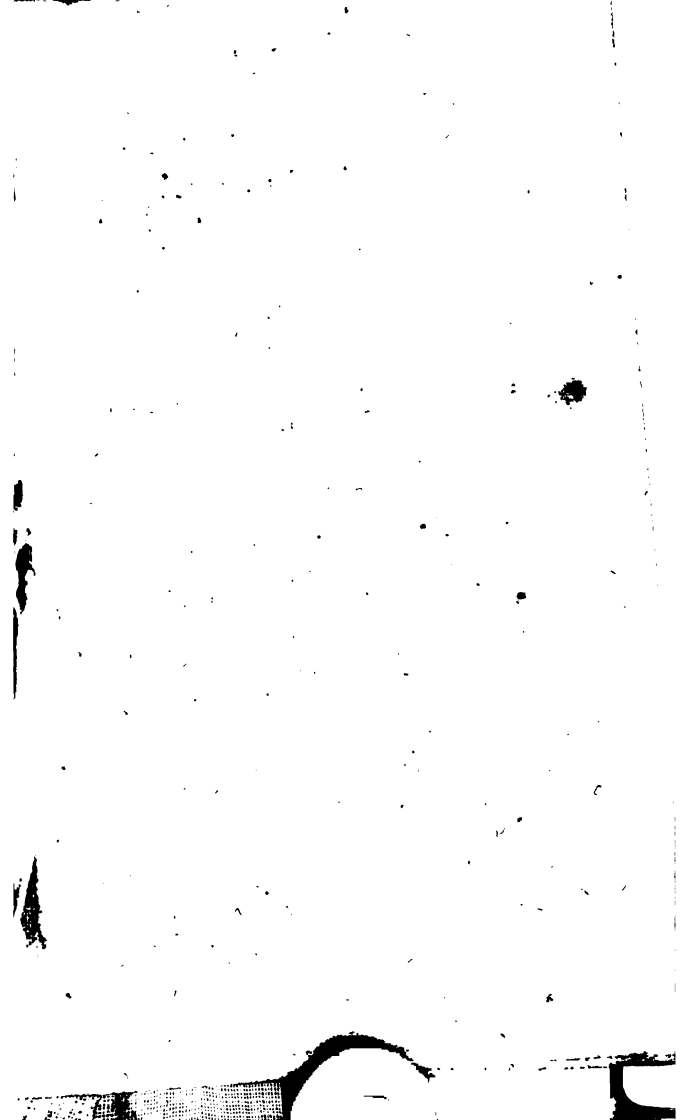
93. Why do others appear black?

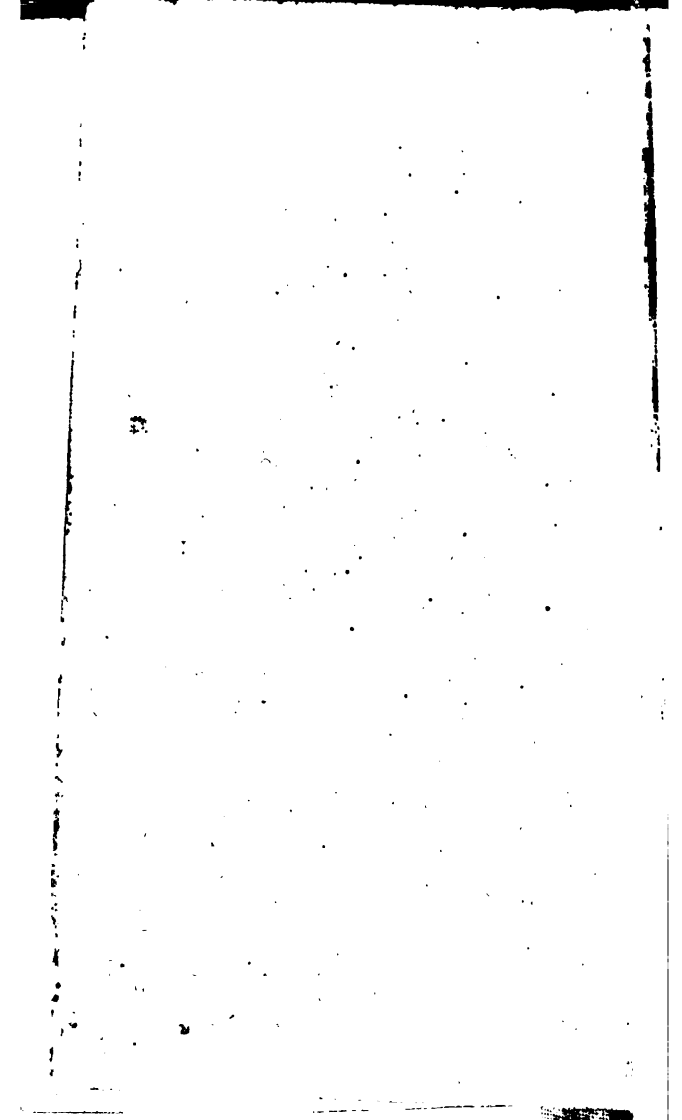
94. How fast do the rays of light move?

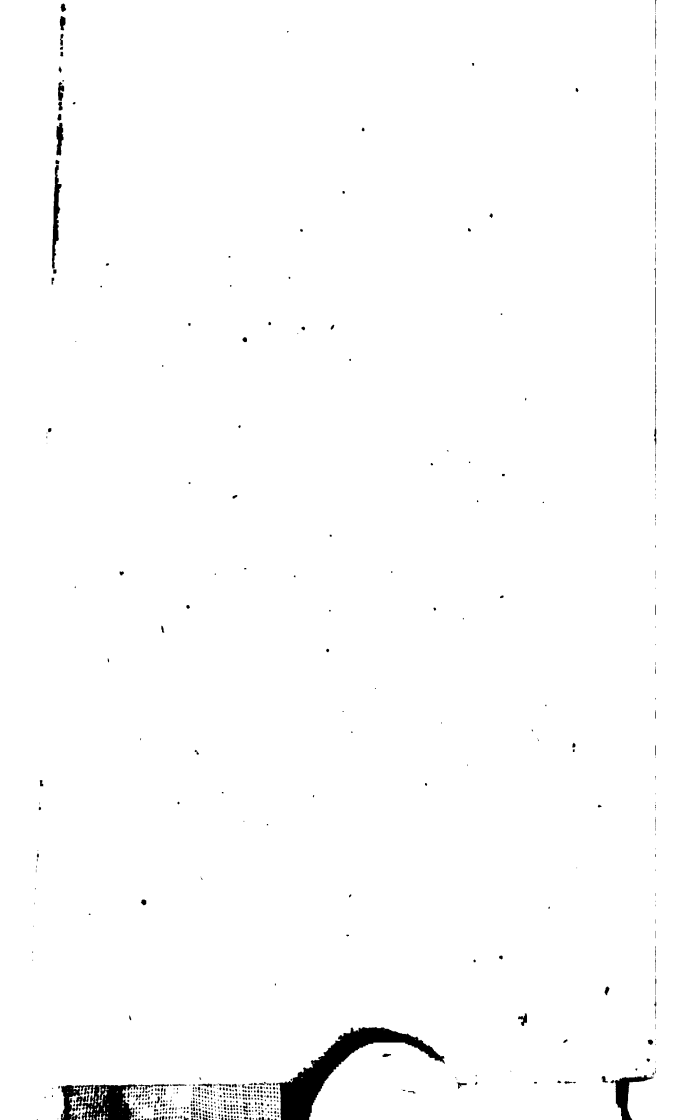
95. When are the rays of light bent?

96. How long do we see the sun after he is below the horizon?

97. What occasions twilight?











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